WATER QUALITY

This sheet documents quality of both ground and surface water in the study area. Samples from 20 ground-water and 11 surface-water sites were collected and analyzed in order to characterize ambient water quality throughout the

Ground Water

The Kirkwood-Cohansey aguifer system is the major source of drinking water in the basin; therefore, the quality of this water is of great importance. Water has the capacity, through various chemical processes, to dissolve and transport minerals and gases. In general, chemical characteristics of the ground water are controlled by temperature, pressure, and duration of contact with lithologic materials. The quality of water in an unconfined aquifer, such as the Kirkwood-Cohansey aquifer system, can vary more than that of a confined aquifer as a result of the water table's proximity to land surface and its lack of an overlying regional confining unit to impede the

For this study, 20 ground-water-sampling sites in the Kirkwood-Cohansey aquifer system throughout the basin were selected (fig. 4-1). Sites were selected to ensure adequate representation of ground water from all parts of the basin. Wells located near, or on, landfills and hazardous-waste sites or thought to be influenced by contamination were not selected. Wells that had been sampled recently, during 1985-88, were selected. Table 4-1 lists these 20 wells with the results of the most recent water-quality analysis. None of the 20 wells contained any of the constituents measured in concentrations that exceed the USEPA primary drinking-water regulations (U.S. Environmental Protection Agency, 1988a and 1988b); however, water from several wells exceeded the USEPA secondary maximum contaminant level (U.S. Environmental Protection Agency, 1988c) established in accordance with the Safe Drinking Water Act (PL 93-523). Water from 6 of the 20 wells exceeded the limit of 0.3 mg/L (milligrams per liter) for iron, water from 3 of the 20 wells exceeded the limit of 0.05 mg/L for manganese, and water from 18 of the 20 had a pH less

downward movement of surface-related constituents. (See Heath, 1987.)

than the acceptable range of 6.5 to 8.5.

Stiff diagrams of the 20 ground-water samples collected are plotted on figure 4-1. These diagrams illustrate the concentrations in milliequivalents per liter of the major cations to the left of the vertical axis and of the major anions to the right of the vertical axis. The anions in the diagrams, listed in the order in which they appear in the diagram, are chloride, sulfate, carbonate plus bicarbonate, and nitrate plus nitrite. The cations, listed in the order in which they appear in the diagram, include sodium plus potassium, magnesium, calcium, and iron. The width of the diagram is an approximate representation of the total ionic content of the water at that site. Differences in the ionic composition of the samples can be evaluated by comparing the shapes of the figures.

Land use significantly affects the quality of the ground water in the Great Egg Harbor River basin. In the upper part of the basin, agricultural land predominates (fig. 4-1). Stiff diagrams show high ionic concentrations of nitrate plus nitrite and magnesium associated with water samples from wells located on agricultural land (fig. 4-1). The relatively high concentrations of these constituents may be the result of the leaching of lime or fertilizer that is applied to the agricultural land and (or) leachate from feedlots or septic systems. The ground-water samples from the upper part of the basin also show relatively high ionic concentrations of sodium plus potassium and chloride, possibly as a result of percolation of leachate from agricultural land where the application of fertilizers and lime has been practiced, and (or) salt-laden leachate derived from deicing the roads.

The lower half of the basin contains less agricultural land and more forested land, wetlands, and water (fig 4-1). Human influences have little effect on the ground water in the lower part of the basin, as reflected by the water quality. In ground-water samples from the lower part of the basin, sodium plus potassium and chloride are again the dominant ions, but are present in lower concentrations than in the ground-water samples from the upper part of the basin. The Stiff diagrams also indicate that ground-water samples from the lower part of the basin contain little or no nitrate plus nitrite or magnesium (fig. 4-1). Precipitation in the basin, dominated in composition by sodium and chloride ions (Lord and others, 1990), is filtered through relatively chemically inert sandy soils and the "clean" quartz sand found in the lower part of the basin. The Stiff diagrams of the composition of ground-water samples from the lower part of the basin indicate that the chemical composition of the water has not changed significantly and is similar to that of rainwater.

Water samples from several wells had ionic compositions that differed from those of water samples from the majority of the wells in the basin (fig. 4-1). Especially notable is the ionic composition of the water samples from wells 1-699 and 1-769. These two wells, screened near the base of the aquifer system, contain water with higher concentrations of calcium and bicarbonate plus carbonate and a higher pH than the water in all the other wells sampled. These characteristics may be a result of the weathering of reactive clay minerals and the dissolution of carbonaceous shell material from strata near the base of the aquifer system.

Table 4-1.--Selected results of ground-water-quality analyses for 20 wells

[Site locations are shown in figure 4-1; NGVD, National Geodetic Vertical Datum of 1929 (referred to in this report as "sea level"); μ S/cm, microsiemens per centimeter at 25 degrees Celsius; deg C, degrees Celsius; mg/L, milligrams per liter; *, analysis done by using whole-water total fixed-endpoint titration; μ g/L, micrograms per liter; --, no reported value; E, estimated value; constituents not detected in a sample are reported as the value

New Jersey well number	Local name			Date ampled		surface datum (feet above	Spe- cific con- duct- ance, field (µS/cm)	lab	ard	(stand- ard	Temper- ature, air (deg C)	Temper- ature, water (deg C)	Oxygen, dis- solved (mg/L)
1-154 1-163 1-230 1-655 1-699	Fire Prot 1952 HTMUA 1(W 5 ACGS 4A		10 09 12 07	- 03 - 85 - 06 - 85 - 06 - 88 - 10 - 87 - 10 - 86	157.00 53.00 85.70 98.00 160.00	55.0 55.0 70.0 80.0 40.0	26 16 49 39 155	31 16 43 41 173	5.20 5.40 5.20 5.25 8.01	5.80 5.30 5.80 5.70 8.00	82.0	14.5 13.0 14.0 12.5 12.5	6.7 7.8 4.4 2.7 0.2
1-762 1-763 1-764 1-766 1-767	Klotz 1 Farnswort Slaybaugh Houde 2 Martinell	1	12 02	-30-89 -05-88 -26-86 -30-85 -01-88	81.00 60.00 114.00 140.00 126.00	80.0 70.0 50.0 20.0 10.0	E40 19 23 27 59	40 19 28 29 71	4.93 5.03 5.30 5.30 5.26	5.40 5.30 5.80 5.70 5.40	::	13.5 11.5 11.0 13.5 13.0	8.4 10.3 5.9
1-769 1-793 1-833 7-603 15-365		lew per Domesti e Fire Dep	ic 12 ot 12 12	- 26 - 85 - 13 - 88 - 06 - 88 - 02 - 88 - 20 - 86	139.00 106.08 80.00 120.00 144.00	10.0 105 57.0 140 140	132 178 25 127 68	121 180 26 125 68	7.20 5.60 5.37 5.02 4.30	7.30 5.90 7.40 5.00 4.60		13.0 13.5 13.0 13.0 13.0	.2 5.4 7.7 7.5 4.2
15-619 15-732 15-734 15-752 15-812	Hospitali Biagi H1 Dase 1 Decora 1 Corona 1	ty Campgro	12 08 09	- 15 - 88 - 11 - 86 - 26 - 88 - 29 - 88 - 24 - 88	98.00 89.00 110.00 120.00 100.00	105 110 138 128 123	36 159 51 52 38	158 52	4.20 4.65 4.70 4.80 5.20	5.11 5.20	7.5	14.0 12.0 15.5 14.0 17.5	5.8 8.5 8.4 14.0 6.0
New Jersey well number	Acidity (mg/L as H+)	Calcium, dis- solved (mg/L as Ca)	Magne- sium, dis- solved (mg/L as Mg)	Sodium, dis- solved (mg/L as Na)	Potas- sium, dis- solved (mg/L as K)	*Alka- linity, field (mg/L as CaCO3)	*Alka- linity, lab (mg/L as CaCO3)	Sulfate dis- solved (mg/L as SO4)	Chlo- ride, dis- solved (mg/L as Cl)	Flou- ride, dis- solved (mg/L as F)	Silica, dis- solved (mg/L as SiO2)	Solids, residue at 180 deg C, dis- solved (mg/L)	e gen, nitrate dis- solved (mg/L
1-154 1-163 1-230 1-655 1-699	::	0.36 .48 1.3 1.6 28	0.39 .29 .78 1.1 1.6	2.5 1.4 4.0 1.8 3.8	0.60 .30 .80 .90 2.3	3 4 6 4 74	3.0 3.0 4.0 2.0	2.4 <0.2 2.5 4.9 8.8	5.1 2.3 5.2 4.5 2.3	<0.10 < .10 < .10 < .10	5.5 9.5 8.8	20 12 38 139	0.13
1 · 762 1 · 763 1 · 764 1 · 766 1 · 767	::	.71 .22 .40 .46 1.6	.63 .32 .50 .45	2.1 1.9 2.9 2.8 6.1	.70 .40 .40 .60	3 4 4	2.0 2.0 1.0 2.0 3.0	9.8 .6 2.0 7.4	3.0 3.3 5.2 4.7 9.4	< .10 .10 < .10 < .10 < .10	4.6 5.4 7.6	15 25	::
1-769 1-793 1-833 7-603 15-365	0.2	9.2 10 .31 7.2 1.8	5.1 4.8 -50 4.8 1.8	4.1 12 2.3 5.6 3.9	3.9 4.1 1.0 2.2 1.5	50 29 5 3	42 7.0 3.0 2.0 <1.0	10 15 < .2 8.9 4.1	2.3 14 3.8 14 5.2	.10 < .10 < .10 .10	7.0 5.1 8.7	104	.36 .35
15-619 15-732 15-734 15-752 15-812	::	1.1 6.1 .81 1.6 1.2	.86 8.3 2.8 1.9 1.3	2.2 3.6 2.1 3.0 3.1	1.3 4.1 1.0 1.2 .70	<1 <1 1 4	<1.0 2.0 1.0 1.0 3.0	3.9 .6 .5 .3	4.3 16 7.7 4.6 4.4	< .10 < .10 .10 < .10 < .10	6.1 6.4 21	99	2.1
New Jersey well number	Nitro- gen, nitrite, dis- solved (mg/L as N)	Nitro- gen, NO2+NO3, dis- solved (mg/L as N)	Nitro- gen, ammonia, dis- solved (mg/L as N)	Nitro- gen,am- monia + organic dissolved (mg/L as N)	Phos- phorous ortho, dis- d solved (mg/L as P)	inum, dis-	Arsenic dis- solved (µg/L as As)	, Barium, dis- solved (μg/L as Ba)	Beryl- lium, dis- solved (µg/L as Be)	Cadmium dis- solved (μg/L	dis- solved (μg/L	(µg/L	dis- dis- d solved (µg/L
1-154 1-163 1-230 1-655 1-699	0.020 < .010 .010 < .010 < .010	0.15 < .10 1.1 .48 < .10	<0.010	0.20	<0.010 < .010 < .010 < .010 .010	40 60	<1 <1 <1 <1 <1	36 25	<0.5 < .5	<1 <1 <1 <1 <1	<5 40	<1 <1 <1	<3 <9
1-762 1-763 1-764 1-766 1-767	< .010 < .010 < .010 .010 < .010	< .10	< .010 < .010 < .010	< .20 < .20 < .20	< .010 < .010 < .010 .010 < .010	50 60 30	<1 <1 <1 <1	19 12 58	< .5 < .5 < .5	<1 <1 <1 <1 <1	<5 <5 <5	 <1 <1	3 3
1-769 1-793 1-833 7-603 15-365	< .010 < .010 .020 < .010	<.10 9.1 .38 5.6	.020 < .010 < .010 .010	.30 .20 .50	.170 .010 < .010 < .010 < .010	80 <10 100 290	<1 <1 <1 <1	180 23 130 62	< .5 < .5 < .5 < .5	<1 <1 <1 <1	<5 <5 <5	<1 	্ব ব্ৰ ব্ৰ
15-619 15-732 15-734 15-752 15-812	< .010 < .010 < .010 < .010 < .010	1.1 11 2.2 3.4 2.1	< .010 < .010 < .010 .020 .060	.20 .80 .30 .50	< .010 < .010 < .010 .010 .010	100 100 40 40 <10	<1 <1 <1 <1 1	37 250 130 66 36	< .5 < .5 < .5 < .5	<1 <1 <1 <1 <1	<5 <10 <5 <5 <5	<1 	<3 <3 <3 <3
New Jersey well number	Copper, dis- solved (µg/L as Cu)	Iron total recov- erable (µg/L as Fe)	Iron, dis- solved (μg/L as Fe)	Lead, dis- solved (μg/L as Pb)	Lithium dis- solved (μg/L as Li)	dis- solve (μg/L	Mercur dis- d solve (μg/L	dis- d solve (μg/L	tium dis- d solve (μg/L	n, dium, dis- ed solve (μg/L	Zinc, dis- ed solve (µg/l	dis- ed solved (μg/l	ic, d Phenol total
1-154 1-163 1-230 1-655 1-699	30 <30		110 6 1,300 1,000 79	9 5 <10 <10	<4 <4	8 <1 44 12 12	<0.1 < .1	<10 <10	20 11	<6 <18	81 8	0.3	<1 <1 3 3 4
1-762 1-763 1-764 1-766 1-767	<10 40 <10		2,500 95 140 <3 770	<10 <10 2 6 <10	<4 <4 4	11 2 6 4 13	< .1 < .1	<10 <10 <10	5 3 15	<6 <-6 <-6	910 27 29	.2	3 <1 <1 1
1-769 1-793 1-833 7-603 15-365	<10 <10 <10 20	::	430 15 44 91 180	1 <10 <10 <10 <10	<4 <4 <4 4	23 59 13 31 15	1.0	<10 <10 <10 <10	67 5 40 15	<6 <6 <6	23 810 10 83	.4 .3 .4	5 1 1 <1 2
15 - 619 15 - 732 15 - 734 15 - 752 15 - 812	20 10 160 <10 <10	80	120 35 10 95 620	<10 <10 <10 <10 <10	<4 <4 <4 10 <4	9 64 11 92 45	< .1 < .1 < .1 < .1	<10 <10 <10 <10 <10	11 67 21 130 11	<6 <6 <6 <6	98 9 10 7 52	.8	4

Surface Water

Table 4-2 summarizes the surface-water quality in the Great Egg Harbor River and its tributaries. Six surfacewater sites (fig. 4-1) were selected by determining those for which the greatest amount of water-quality data from the last 15 years (1975-90) was available, and to ensure an even distribution of sites along the length of the river. The period of record from 1975 to 1990 for which water-quality data are available is given for each site in the table. Water-quality records for only three of the six sites contain data from the entire 15 year (1975-90) period. Maximum, mean, and minimum concentrations for the period of record are listed for each constituent in the table. The number of samples represented by those values is also listed for each site for every constituent. The six mean concentrations for each constituent were averaged to obtain the mean concentration of each constituent at all six sites; these values are listed in the final column of the table.

Stiff diagrams for 11 surface-water sites were plotted in figure 4-1 to show the general ionic composition of the surface water throughout the basin. Data for dissolved iron at the surface water sites are unavailable; therefore, a value of zero was inserted in the diagrams. The nearly equal amount of positive and negative charge in the diagrams indicates that dissolved iron is a minor constituent of the surface water. Concentrations of total nitrate plus nitrite were used in place of unavailable concentrations of dissolved nitrate plus nitrite for the surface-water Stiff diagrams. Because nitrate is highly soluble, and because the water contains only insignificant concentrations of nitrite, the concentrations of total nitrate plus nitrite are likely to be nearly equal to the actual concentrations of dissolved nitrate plus nitrite.

Water-quality data from 3 of the 11 surface-water sites--01410784, 01410820, and 01411110--are for surface-water samples collected in January 1990, whereas the most recent data from the remaining 8 sites are for surface-water samples collected in June or December 1978. Table 4-3 lists the date on which each sample was collected. In order to ensure that the combination of data from these two sampling periods (1978 and 1990) is representative of surfacewater quality in the basin, data from 1978 and 1990 were compared. Stiff diagrams of water-quality data from each site at the same time of year in 1978 and 1990 were compared, as were Stiff diagrams of data from one site at different times of the year. The ion concentrations in the water at these 11 sites are listed in table 4-3. The surface water is richer in the cations sodium plus potassium and calcium than in magnesium; chloride and sulfate are the predominant anions.

course of the river, the concentrations of these constituents decrease downstream. The surface water in the upper part of the basin generally contains higher concentrations of many constituents than the surface water farther downstream.

The 11 surface-water Stiff diagrams show that although the dominant cations and anions remain the same along the

Land use in the upper part of the basin affects the ion concentrations in the surface water (fig. 4-1). The higher density of urban areas in the upper basin, such as the city of Berlin, N.J., at the headwaters of the river, results in increased runoff carrying more dissolved material to streams. Soluble material in fertilizers applied to agricultural land, and salty leachate during the winter months from road deicing, percolate to the water table and are transported to nearby surface-water bodies as base flow. Many of the areas in the upper part of the basin that are classified as urban in figure 4-1 are actually recently developed land or residential areas. In these areas, constituents of lawn fertilizers and effluent from leaky septic systems percolate to the water table and become base flow and (or), during periods of heavy rain, material is washed from streets into storm sewers and into the river. The wetlands along the banks of the river are another source of dissolved material. During periods of low flow, when the swamps and marshes dry up, soluble salts and decaying vegetation are left behind. During periods of heavy rain, this material is washed into the stream, increasing the dissolved-solids content of the water until the wetlands soil is leached and the residual material is diluted. Because the volume of the river at this location in the basin is relatively small, the sudden addition of this dissolved material has a large effect on the concentration of solutes in the surface water.

The downstream part of the Great Egg Harbor River basin is composed mostly of forest and wetlands (fig. 4-1). Because human influences on the chemistry of the surface water in this part of the basin are minimal, concentrations of dissolved solids are lower than in the upper part of the basin. Water in this area filters through leached, sandy soils and "clean" quartz sand in which little material is available for dissolution before contributing base flow to the surface-water system. Additionally, the volume of water in the river increases downstream, further diluting the dissolved material that is transported from the upstream part of the basin.

This difference in ionic concentration is also visible in the time-series graphs in figure 4-2, which display the concentrations of several constituents over the last 10 years (1980-90) at the three sites for which data are available--01410784, 01410820, and 01411110. Site 01410784 is farthest upstream and 01411110 is farthest downstream (fig. 4-1). Figure 4-2 shows that the concentrations of dissolved sodium, potassium, calcium, chloride, sulfate, and dissolved solids are consistently lower at the downstream site than at the upstream site. A similar trend is observed for specific conductance, total phosphorous, alkalinity, and, to a lesser extent, dissolved magnesium and

The time-series graphs for the surface-water site in the upper part of the basin show higher peaks in concentration than the graphs for the other two sites, primarily as a result of the concentration of urban and residential developments in the upper basin. As mentioned above, during periods of heavy rain large amounts of dissolved material are washed into the surface water. Because the volume of the river in the upper part of the basin is smaller than in the lower part, this increase in dissolved material has a greater effect on the concentrations of solutes, producing larger peaks.

Table 4-3.--Concentrations of major ions in surface water at selected sites in the Great Egg Harbor River basin [Site locations are shown in figure 4-1; all values in milligrams per liter; <, less than]

total nitrate plus nitrite.

Station		Date	Dissolved						Total	
number	Station name	sampled	Sodium	Potassium	Magnesium	Calcium	Chloride	Sulfate	Bicarbonate	Nitrate + Nitrite
01410775	Great Egg Harbor River at Berlin, N.J.	06-27-78	12	2.4	2.6	9.0	19	12	22	0.92
01410784	Great Egg Harbor River near Sicklerville, N.J.	01-25-90	7.1	1.9	1.4	3.8	11	10	5	.57
394203074562901 New Brooklyn Lake at Winslow Crossing, N.J. 12-05-78		12-05-78	7.2	2.3	2.2	4.6	11	16	5	1.0
01410803	Fourmile Branch at Winslow Crossing, N.J.	12-05-78	5.7	1.9	2.5	3.5	10	16	1	1.0
01410820	Great Egg Harbor River near Blue Anchor, N.J.	01-25-90	5.6	1.3	1.4	2.9	8.3	7.0	5	.72
01410865	Squankum Branch at Malaga Road near	06-27-78	3.6	1.9	2.2	6.8	5.3	8.7	17	1.3
	Williamstown, N.J.									
01411053	Hospitality Branch at Berryland, N.J.	06-27-78	2.7	0.90	0.90	1.5	4.9	5.6	2	.10
01411080	Hospitality Branch at Penny Pot, N.J.	06-28-78	2.4	.80	.80	0.90	4.1	6.5	2	.11
01411110	Great Egg Harbor River at Weymouth, N.J.	01-25-90	4.6	1.1	1.2	2.1	8.2	7.0	2	.45
01411140	Deep Run at Weymouth, N.J.	10-10-78	3.3	1.1	.90	1.9	5.2	7.9	4	<1.0
01411196	Babcock Creek near Mays Landing, N.J.	06-29-78	4.1	1.2	.80	1.5	8.1	7.2	2	.16

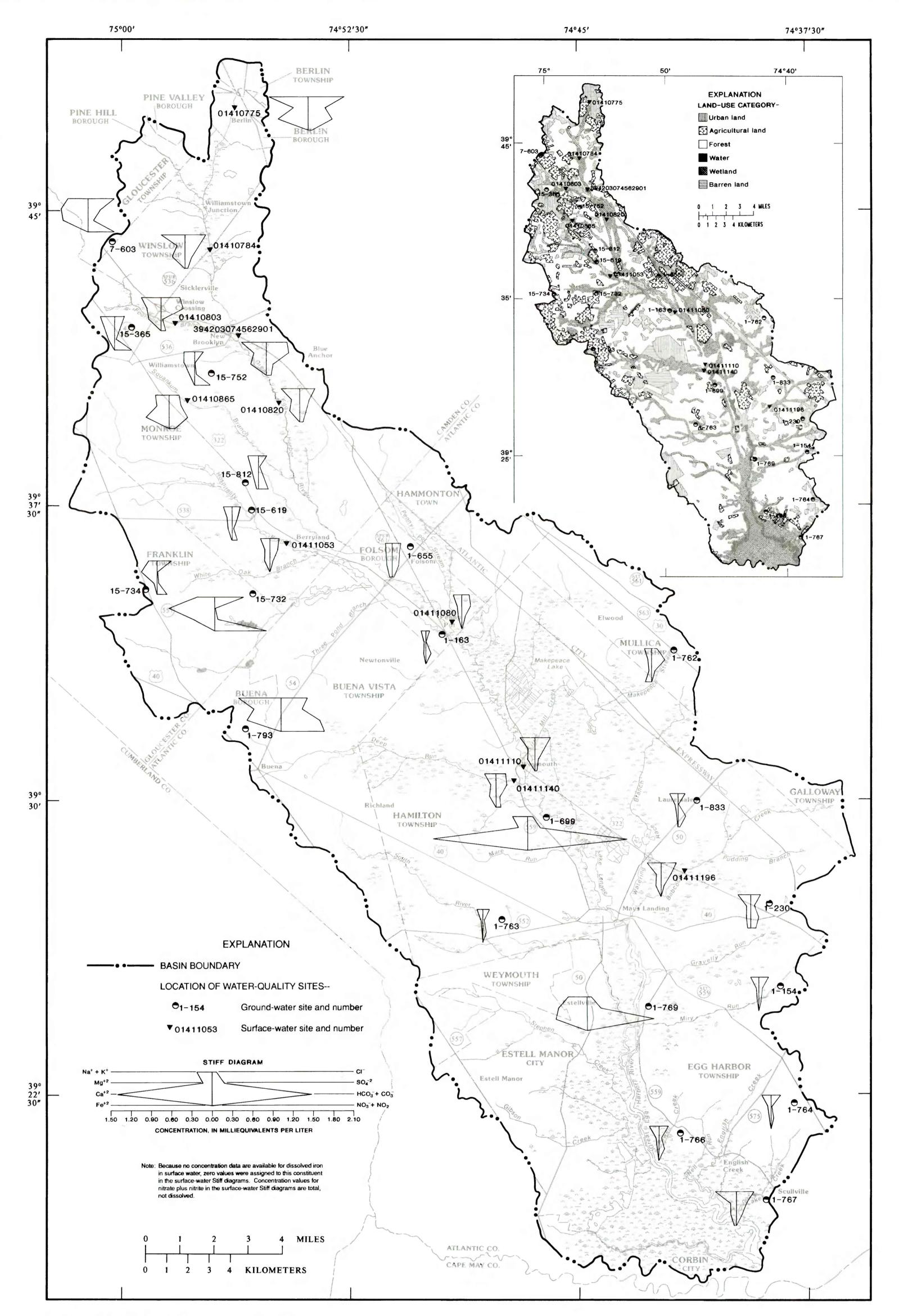


Figure 4-1. -- Locations of water-quality sites, land use, and Stiff diagrams showing the chemical composition of water in the Great Egg Harbor River basin study area.

Table 4-2.--Summary of water-quality data for selected surface-water sites in the Great Egg Harbor River basin

Base from U.S. Geological Survey, 1:24,000, quadrangles, Ocean City, 1952;

Williamstown, 1966; Hammonton, 1966; Clementon, 1967; Runnemede, 1967

Mays Landing, 1955; Pleasantville, 1952; Green Bank, 1956; Egg Harbor City, 1956;

Marmora, 1952; Tuckahoe, 1956; Five Points, 1956; Dorothy, 1956;

Newtonville, 1953; Buena, 1953; Newfield, 1953; Pitmen East, 1966;

[Site locations are shown in figure 4-1; *, one or more of the values used to calculate the mean was accompanied by a remark. Remarked values were either less than (<) or greater than (>) the given value, or values were estimated. Remarked values were used without the accompanying remark in calculating the mean; deg C, degrees Celsius; μ S/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; BOD, 5-day biochemical oxygen demand at 20 degrees Celsius; std unit, standard unit; alkalinity analysis done by using whole-water total fixed-endpoint titration; MPN, in the most-probable-number (MPN) method, bacteria are grown from the sample in a nutrient solution and the most probable number of organisms is calculated from the amount of gas produced. EC broth refers to a specific mixture of nutrients that is used for growing bacteria by this method]

Site 01410775 Site 01410784 Site 01410865 Site 01411080 Site 01410820 Site 01411110 Great Egg Harbor River at Great Egg Harbor River at Great Egg Harbor River Great Egg Harbor River Squankum Branch at Malaga Hospitality Branch at Road near Williamstown, N.J. Berlin, N.J. near Sicklerville, N.J. near Blue Anchor, N.J. Penny Pot, N.J. Weymouth, N.J. 01/02/75 to 01/25/90 06/25/75 to 06/27/78 07/15/75 to 06/28/78 01/02/75 to 01/25/90 06/25/75 to 06/27/78 06/25/75 to 01/25/90 Number Number Number Number Constituent Units samples Maximum Mean Minimum (six sites) Water temperature 23.0 12.4 0.5 140 deg C 23.0 12.6 0.5 15.3 22.0 4.5 24.8 17.0 4.5 25 Specific conductance, 25 deg C μS/cm 206 103 116 116 201 63 42 33 61 118 43 Dissolved oxygen 12.2 1.8 113 8.5 mg/L 11.5 6.8 14.6 4.2 13.6 6.6 0.8 12.5 8.1 5.0 13.7 9.0 5.0 7.5 *5.2 7.1 2.2 .3 108 5.0 1.4 2.3 mg/L .2 1.1 0.2 2.6 *1.0 4.0 std unit 3.40 5.35 3.83 5.89 Alkalinity, field mg/L as CaCO3 *2 Total nitrogen 2.5 .62 5.9 mg/L as N 1.8 -85 5.4 .54 1.1 0.61 -28 0.99 .42 2.2 Total nitrogen, ammonia 0.502 .010 2.10 *0.365 < .010 *0.139 < .010 *2.42 < .010 0.080 * .026 < .010 0.350 mg/L as N * .100 < .010 0.592 Total nitrogen as nitrite * -027 * .027 0.410 < .003 *0.047 < .010 .010 mg/L as N .050 * .013 < .003 * .010 < .010 .016 * .008 < .003 Total nitrogen as nitrate 1.0 .07 1.8 .21 mg/L as N .48 .43 .06 .02 Total nitrogen, ammonia + organic mg/L as N 6.2 1.3 -37 .17 4.2 .17 * .63 .13 - 11 Total nitrogen, nitrite + nitrate mg/L as N *1.4 *1.1 3.6 1.9 .06 .03 .22 1.0 5.6 .08 .06 * .50 .03 1.0 Total phosphorous 1.27 mg/L as P .010 .010 .010 .024 .610 * .090 < .010 .366 7.7 Total organic carbon mg/L as C 45 1.6 109 9.2 1.4 7.5 9.6 Total hardness mg/L as CaCO3 Dissolved calcium mg/L as Ca 2.9 3.7 1.9 .80 2.2 1.3 Dissolved magnesium 3.4 2.1 2.5 mg/L as Mg Dissolved sodium 2.8 2.7 mg/L as Na Dissolved potassium mg/L as K .90 1.2 2.2 .70 Dissolved chloride mg/L as Cl 46 5.5 99 120 2.8 7.0 Dissolved sulfate 31 5.7 2.8 mg/L as SO4 <1.0 Dissolved silica 3.8 mg/L as \$i02 6.0 15 5.7 7.3 5.5 3.9 5.7 2.4 5.2 Fecal coliform, EC Broth, 44.5 deg C MPN 26 >2,400 *780 <2 78 1,700 *200 >2,400 24 >24,000 *2,600 920 *88 5,400 9,200 *1,300 13 *910 49 *13 Fecal streptococci 72 54,000 *1,600 >2,400 77 <2 73 >24,000 *1,300 15 <2 7,000 *590 <2 <2 940 350 230 Dissolved solids, sum constituents mg/L 69 110 62 71 68 27

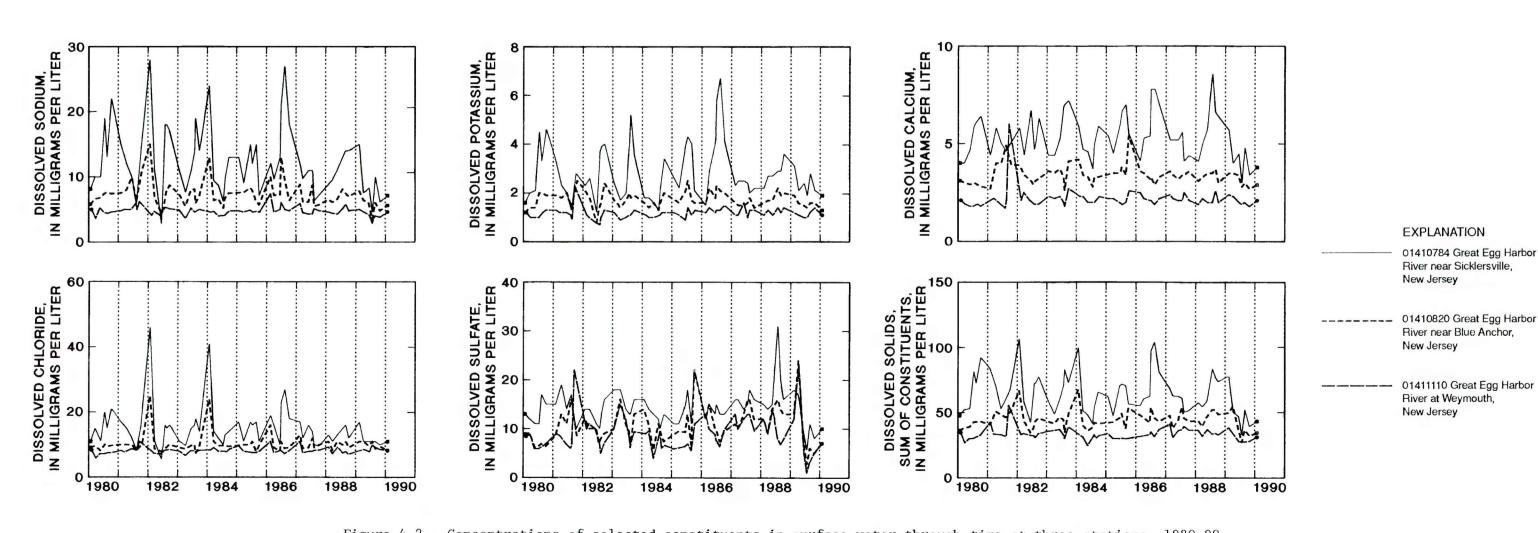


Figure 4-2.--Concentrations of selected constituents in surface water through time at three stations, 1980-90,